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# THE STRUCTURE OF THE SCALES OF LEPISMA SACCHARINA.

BY G. W. MOREHOUSE.

FOR many years this test has been subjected to most careful and critical examination by the most competent observers and with the best microscopes, but, after all, the true character of its markings still remains a disputed question. These differences of opinion have evidently arisen partly from the complex nature of the markings themselves, and partly from the different conditions under which they have been seen. In this scale we have coarse ribs easily seen with a very ordinary glass, and on the other hand delicate structures severely taxing the powers of the finest objectives in existence. This fact alone is sufficient to account for the want of agreement, without accusing any person of being biassed by a theory; while those observers who think their own instruments are the best will continue to be satisfied with what they may happen to see, and shut their eyes to any advance.

As the microscope has been improved, our ideas of the structure of the Lepisma scale have been gradually modified, and who will now claim it to be "too easy for a test object?"

In the order of difficulty of resolution we have—

1. The heavy longitudinal ridges running from end to end of the scale and slightly projecting at the point.
2. Distinct ribs generally radiating from the quill, or curved parallel with the outline of the scale, and becoming faint in the centre and parts remote from the quill.
3. Transverse corrugations of the membranes.
4. Faint irregular veins branching from the diverging ridges (No. 2) generally taking a transverse direction, and, together with the corrugation, causing the spurious appearance of fine beading at their points of intersection with the ridges.

To make sure of my work on this scale I have studied it under a number of different conditions. The observations have been conducted with monochromatic sunlight; with white cloud and lamp; with central beam and oblique; with mirror, prisms, achromatic condenser with and without central stops, and with Wenham's paraboloid. All these methods point to the same conclusions. Following up the line of observations described by the late Richard Beck, in his most valuable contribution to our knowledge of this subject, the same results were arrived at in regard to the appearance of coarse beading, etc., viz., "that the interrupted appearance is produced by two sets of uninterrupted lines on different surfaces"* That the longitudinal and the oblique lines are on different sides of the scale is also plainly seen by their lying in different focal planes under a $\frac{1}{50}$ objective. And farther, while examining a scale in fluid I have repeatedly observed air bubbles on one surface of it confined by the longitudinal ribs, and on the other side others bounded by the oblique ridges; and on moving the slow adjustment up and down, with the movement of the bubbles under control, they never interfere or mix with each other.† Nothing further is required to prove that these markings are actually ridges and that they project from different surfaces of the object. The experiments of Mr. Beck settle this question.

As microscopical definition advanced the very feeble radiating lines were noticed in the spaces between the ribs, formerly thought to be smooth. In the central portion of the test these lines are parallel with the main ribbing. They in their turn were seen to be uneven and pronounced to be "beaded striæ."‡ Must this fine beading like its shadowy predecessors be also extinguished by intersecting cross lines and so add one more to the long list of illusory appearances? To attempt to throw some light upon this question is the principal object of the present article.

In the first place, it is far from being a difficult feat to see this beading. Any first class lens, from a $\frac{1}{5}$ upward, when properly handled, will display it or something very like it. The writer has found it an easy task with Wales' $\frac{1}{15}$ immersion, or even with a Beck $\frac{1}{5}$ and deep eye-piece. With Tolles' $\frac{1}{50}$ immersion the fine transverse structure indicated above is brought out, and it becomes at once evident that the small beads are indeed spurious like their big brothers, and for a similar reason.

The fine transverse markings seem to branch from the faint radiating ones and have the appearance of a net-work of minute capillaries. Beside these there are coarser transverse waves or corrugations of the membrane. In numerous instances, air bubbles have been observed imprisoned between the heavy ribs on one or two sides, and by these corrugations on the other sides. Therefore the corrugations may safely be said to be on the same surface of the scale with the longitudinal ridges, and the branching vein-like structure on or near the other surface. Careful focussing is corroborative of this idea, making it certain that these two details of structure lie in different planes. With monochromatic light, the delineation of this structure is eminently satisfactory, and the effect of the slightest change in focal adjustment is at once felt. When the object is a little out of focus the light is unequally refracted and broken up in passing through this complicated network of ridges and corrugations, and produces an appearance of fine molecules over the whole surface of the scale.

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* The Achromatic Microscope, Beck, p. 50.

† See Micrographic Dictionary, 2d ed., p. 34, Fig. 3, pl. 27.

‡ See M. M. Journal, March, 1873, pl. xi, Figs. 3 and 4.

The coarse and the fine beads both vanishing under advancing definition, together with the behavior of the confined bubbles of air, seems to my mind fully to demonstrate the reality of the structure above described. Often, when the corrections are not perfect, the semblance of beading can be directly traced to a seeming enlargement of points of linear intersection and branching. When the $\frac{1}{50}$ is at its best work the finer transverse markings are usually irregular both in strength and direction but always unmistakable. They may be plainly seen on some of the smaller scales and in the central parts of the larger, and at almost as good advantage as near the edges of the easier scales. Sometimes they are continuous across several intercostal spaces and again only extending across one, or it may be merely budding, as it were, from the ribs. It will be noticed that the "beads" as drawn by Mr. Hollich exhibit corresponding irregularities.

In conclusion the remark of Beck on the scales of Lepidocyrtus may well be quoted—"and my own belief is that the markings upon this and all other varieties of Podura-scales are more or less elevations or corrugations upon the surface, which answer the simple purpose of giving strength to very delicate membranes."* If this idea is true of the Podura it applies with greater force to the complicated ridges of Lepisma.

The same original structure is often modified in diverging directions so as to subserve totally distinct purposes. And as hairs are probably modified scales, and a regular gradation may be traced between them, so the connecting chain is filled up between ribs extending from end to end of a scale, through undulations and shorter ribs, to those slightly projecting, and so on to the perfect spine or secondary hair.

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*Transactions R. M. S., 1862, p. 83.

# THE NORTH AMERICAN GOATSUCKERS.

BY DAVID SCOTT.

THE whippoorwills and nighthawks of North America are by many confounded and considered to be the same species. This impression is, nevertheless, entirely erroneous; and I hope to show, in the following remarks, such obvious differences existing between them as will convince the most superficial observers of their non-identity.

It is surprising that our farmers (for they perhaps are the persons by whom these birds are most generally confounded) should consider such widely separated species, which resemble each other in color only, the same. It exhibits a carelessness which is hardly excusable, for doubtless the majority of them have shot the birds in question, and a simple comparison would surely convince them of their error. That any supernatural ideas should be entertained respecting these harmless and useful birds appears even more surprising; but such is the case with a large number of people, more especially, however, with the uneducated. There is prevalent in various sections of the country a remarkable awe, not to say fear, of them: and various are the misfortunes which are ascribed to their supposed supernatural influence—such as the sudden death of one of the inmates of a house, which, it is affirmed, surely follows the song of the whippoorwill if he be perched upon the door-sill. It is also believed by some that the white spots on the wings of the nighthawks are silver dollars. The pertinacity with which superstitious traditions cling to people is well known, and the foregoing, which are not all that are current respecting these birds, form no exception. They have undoubtedly been handed down and preserved through many generations. It appears remarkable, but there seems to be something about these birds which has excited the superstition of various nations for